

INCENTIVIZING COAL FLEXING TO SUPPORT VARIABLE RENEWABLE ENERGY INTEGRATION AND GRID BALANCING WORKSHOP

August 22 – 23, 2019

New Delhi, India



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United States Energy Association

BACKGROUND

India plans to deploy unprecedented levels of renewable energy (RE) on its power grid – 175 GW installed capacity of renewable energy (RE) by 2022. (Current estimates stand at approximately 77 GW of installed RE capacity.) This will greatly reduce the economy's carbon intensity and strengthen energy security. Compared to conventional power, however, India's key RE options are more variable, less predictable and often further from demand centers. Experience in other systems has shown that when penetration of RE reaches significant levels, the capacity of the power grid to manage it must be addressed to avoid challenges to the reliability and affordability of electricity.

A significant component of India's future success in expanding renewable energy supplies is the development of its capacity to plan and maintain grid stability and reliability while promoting flexibility throughout the power system. This includes coal which provides more than half of India's commercial primary energy and is the dominant fuel for power generation and is expected to remain the dominant fuel in the power sector in India, through 2030 and beyond. In countries such as India with high coal dependence but ambitious goals for integration of variable renewable energy, "hourly ramping" and "daily cycling" of coal power plants is becoming an increasing necessity.

A committee under CEA (Central Electricity Authority – Ministry of Power's policy wing) carried out a study for establishing a roadmap for flexible operation of thermal units in order to support 175 GW RE integration. The report of the committee, which was released in March 2019, establishes the requirement of around 80 GW of flexibility from coal stations by 2022. The report suggested various measures (technical and regulatory) to be adopted to prepare units for flexible operation. Presently, the technical minimum has been mandated by CERC (Central Electricity Regulatory Commission) at 55%. However, despite the mandate, many of the state coal generators are not operating at these minimum loads. Inadequate policy and regulatory mechanisms are one of the main reasons for lack of proactive participation by the generators.

It is important to understand that economic rules will drive the adaptation of technical measures by plant operators and give access to low cost resources needed for balancing. Even access to the latent flexibility in the system will need unlocking through market rules. Proper incentivization rules will help to accelerate investment, innovation and the use of smart, efficient, resilient and environmentally sound technologies, which is crucial for ensuring electricity security in modern power systems.

Regulatory approaches include measures such as allowing for VRE participation in balancing power through AGC (automatic generation control), faster scheduling and dispatch intervals (from 15 minutes to 5 minutes), and certain types of performance-based regulatory approaches. The present DSM (deviation settlement mechanism) is a sort of performance-based regulatory approach. As for economic incentives, providing policy support for reviewing inflexible contract terms and creating new revenue streams for flexibility services can encourage plant owners to operate more flexibly.

The present Indian electricity market is largely based on long term inflexible PPAs (power purchase agreements), with a limited market participation (less than 5%). In the recent past ancillary products (regulation up/down) was introduced. AGC has been recently introduced at four coal stations. A compensation mechanism for compensating the part-load efficiency loss and start-up oil has been introduced, but it compensated only part of the costs. For full compensation for all the products of flexible operations, a concept note has been prepared by USAID Greening the Grid (GTG) Renewable Integration and Sustainable Energy Initiative (RISE) team.

The next step would be to implement a well-designed market mechanism that accurately rewards generators for the system-level economic value of their flexibility and incentivizes increased flexibility. These remuneration mechanisms may be structured around specific services, such as turn down, ramping

during load following or start-up time and could provide additional source of income for power plants that are necessary to the system but unable to maintain business-as usual profitability due to reduced utilization.

Managing this transition to 2022 and beyond will require innovative approaches across the entire power system, spanning both institutional reforms and technical adaptations. This may include a need for governments to change policy, market and regulatory frameworks.

The workshop is aimed at policy makers and regulators for a better understanding of power plant flexibility in order to enhance system planning and upgrade policy, market and regulatory frameworks. It will include case studies of electricity markets of other countries, highlighting the evolution of different balancing products.

WORKSHOP GOAL & OBJECTIVES

Goal:

Coal-fired power generation is facing financial stress in India, as capacity has grown faster than power demand over the last several years. The capacity utilization factor has been continuously coming down. Renewable energy is displacing coal-fired generation, lowering the use of coal plants and reducing their profitability. New privately-owned power plants are particularly struggling. These are often more efficient and flexible in their operation than older plants but are disadvantaged compared to publicly-owned plants in obtaining coal supply and in signing power purchase agreements (PPAs) to sell their power. This problem is likely to get worse before it gets better, since an additional 50 gigawatts of coal-fired generation are under construction in the country and a rapid deployment of VRE has been planned in a short span of time. The base load thermal power stations are required to flex more and more with further addition of RE causing them to be stressed and unable to recover the additional costs in the present regulated market mechanism.

This workshop will provide participants with “next steps” to support the coal generators with the transition from their historical method of operation to the new, load following style to support India’s fast VRE expansion. Participants and presenters will discuss financial, regulatory and policy practices to incentivize and compensate coal flexing for its new role in grid stability, focusing on methods that have been explored in other parts of the world.

Presentations may include discussions on various strategies applied in other regions, including but not limited to:

- 1) Flexible coal generation as a balancing energy market product/ancillary service product
- 2) AGC as a necessary tool in flexible coal dispatch
- 3) Flexible coal generation products for a day-ahead market
- 4) Compensation mechanisms for load ramping, start-ups and turn down
- 5) Practices in other countries for dispatch – what is the basis for dispatching coal?
- 6) Capital cost recovery for investments made for preparing units for flexibilization – mechanisms and global experience
- 7) SCED (security constrained economic dispatch) and market alignment for flexible operations

This workshop will serve as one of the first forums to provide capacity building in this subject area.

Objectives:

The objectives of this activity are to create a platform for peer-to-peer dialogue to share experiences and lessons-learned on the regulatory and market mechanisms for use of coal-powered generation as a flexible resource to balance variable renewable energy generation.

During the workshop, participating organizations will develop Indian context regulatory options for action to enable expanding coal generation flexing and a proposed timeline for achieving highlighted strategies and next steps.

VENUE

[Le Méridien New Delhi](#)

Windsor Place, New Delhi 110001 India

Tel: +91 11 2371 0101

Meeting room: Le Belvedere

PARTICIPANTS

- Central Electricity Authority (CEA)
- Central Electricity Regulatory Commission (CERC)
- Power System Operation Corporation Ltd. (POSOCO)
- NTPC LTD (NTPC)
- Gujarat State Electricity Corporation Ltd (GSECL)

ORGANIZER

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SPEAKERS

Thad LeVar (*confirmed*)

Commissioner Chair, Public Service Commission of Utah

Thad was appointed to the Public Service Commission of Utah by Governor Gary R. Herbert on December 20, 2012, and was appointed Commission Chair by Governor Herbert on June 19, 2015. He had been with the Utah Department of Commerce since 2004, and at the time of his appointment he was the agency's deputy executive director. While in that role Thad was appointed to be a member of the steering committee for Governor Herbert's 2011 Utah Business Regulation Review, a project that resulted in over 300 changes to Utah state government including streamlining and eliminating rules and regulations.

Previously in his career Thad held jobs first as an administrative law judge, and then as division director, with the Utah Division of Consumer Protection. He also worked as an associate general counsel to the Utah Legislature. Before law school, Thad taught in secondary schools in Texas and Arkansas.

At the PSC, Thad has been involved with issues including an overhaul of Utah's Universal Service Fund and significant updates to Utah's PURPA requirements. He has served as a member of the Committee on Energy Resources and the Environment of the National Association of Regulatory Commissions (NARUC), and currently serves on NARUC's Committee on Gas. Thad also served as an inaugural member of the Body of State Regulators for the Western Energy Imbalance Market.

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Jeffrey Hoffmann (TBC)

National Energy Technology Laboratory, Department of Energy Office of Fossil Energy, U.S. Department of Energy

The National Energy Technology Laboratory (NETL) is a U.S. Department of Energy (DOE) national laboratory that produces technological solutions to America's energy challenges. For more than 100 years, the Laboratory has advanced technology to provide clean, reliable, and affordable energy to the American people. NETL's mission is to discover, integrate, and mature technology solutions to enhance the nation's energy foundation and protect the environment for future generations. Through forward-looking research and technology development, our team of talented and diverse experts provides technology solutions for today and options for tomorrow. As the only one of the Energy Department's 17 national labs that is both government-owned and -operated, NETL is in a unique position to accelerate the development of technology solutions through strategic partnerships with academia, industry and other research organizations. NETL is also the only national lab dedicated to fossil energy research and development, making our team a sought-after national resource.

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Dr. Laura Nelson (confirmed)

Governor's Energy Advisor and Executive Director at Utah Governor's Office of Energy Development

Governor Gary R. Herbert appointed Dr. Laura Nelson as his energy advisor in May 2016. She also continues to serve as the executive director for the Governor's Office of Energy Development, a position she has held since 2014. Prior, Dr. Nelson served as the vice president of government and regulatory affairs for Potash Ridge, Corp., the vice president of energy and environmental development for Red Leaf Resources, and the energy advisor for Utah Governor Jon M. Huntsman. For two decades, Dr. Nelson has been proactive in defining and supporting balanced and sustainable energy solutions, including providing Congressional testimony, participating in regional collaborations, working with counties and cities, and coordinating across diverse stakeholders to deliver positive policy, regulatory and commercial results. Dr. Nelson holds a Ph.D. in Economics from the University of Utah and resides with her family in Salt Lake City.

The Utah Governor's Office of Energy Development (OED) was formed in 2011 in response to the Governor's 10-Year Strategic Energy Plan. Led by Dr. Laura Nelson, OED is responsible for implementing the state energy policy (63M-4-301) by facilitating the development of the Utah's diverse energy and minerals sector. The OED provides industry assistance through the administration of state and federal tax incentives, fosters education and technological innovation, and collaborates with a variety of stakeholders in government, nonprofit and the private sector. The office is also dedicated to promoting responsible energy policies, and regularly handles public lands and environmental issues.

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Lawrence Slade (*confirmed*)
Chief Executive
Energy UK

Lawrence Slade is the Chief Executive of Energy UK, the trade association for the GB energy industry with a membership of over 100 suppliers, generators, and stakeholders with a business interest in the production (using all forms of generation), retailing and transmission of electricity and gas for domestic and business consumers.

Lawrence has been involved in the energy industry since the late 1990's working in countries all over the world. Lawrence is a member of the UK Government's Committee on Fuel Poverty, a Board Trustee and Audit Committee member of the Money Advice Trust (who run the National Debt Helpline and Small Business Debt Helpline), and a board director of Eurelectric, a pan European trade association for the electricity industry, he also chairs their Brexit Committee and is a member of their Finance Committee. He is also a Fellow of the Energy Institute, a member of the Institute of Directors, and a Freeman of the Worshipful Company of Fuellers.

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Hans-Jürgen Behnke (*confirmed*)
Head of External Operation & Maintenance Portfolio
RWE

Hans-Jürgen Behnke is a senior expert with over 20 years of experience in the mobilization, operation, maintenance and decommissioning of power plants in national and international projects. He is also extensively experienced in Business Process Reengineering, fleet optimization and overarching efficiency programs.

Before developing RWE's external O&M business, Hans-Jürgen was Managing Director of a Power Company in Belgium as well as Plant Manager in two of RWE's 400MW CCPPs and responsible for the mobilization and management of several gas- and coal-fired power stations. His expertise covers large due diligences, set-up and management of joint-venture-companies as well as strategic business process reengineering projects for the RWE Group with a strong focus on generation.

He holds a diploma in industrial engineering, international management and process optimization from the University of Paderborn in Germany.

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Serhiy Zuyev (*confirmed*)
Market Business Leader, AES UK & Ireland

Serhiy was appointed as AES UK & Ireland Market Business Leader in August 2018. He is an established professional in the energy field, with over 20 years of experience in financial management and leadership. He rejoined AES after a 1-year stint as CFO for the Svarog West Group. Prior to moving there, he worked for AES in several different roles and markets. He joined the company in 2010 as CFO and Shared Services Director for AES Ukraine, moving on to the role of CFO and Head of the Alberich branch for AES Kazakhstan in June 2013 and finally taking up the position of Market Business Leader in Kazakhstan in April 2015.

Prior to joining AES in 2010, he spent over a decade at Kraft Foods Ukraine, working in several brand management and financial roles, before moving to Maharishi Organic Agriculture as CFO, and returning to Kraft Foods as Financial Manager - New Markets Eastern Europe and Central Asia in 2009.

Born in the Russian city of Petropavlosk-Kamchatskiy, Serhiy holds a Degree from the Ivano-Frankivsk State Technical University for Oil and Gas in Microeconomics in the Energy sector.

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Richard Way (*confirmed – presenting via videoconference*)
President, Way Consulting Ltd.

Mr. Way advises on a range of electricity matters, including market design, regulation, power contracting, transmission, grid operations, asset valuations and strategic planning. Mr. Way has broad experience in industry restructuring in Alberta, Ontario and Northwest USA. He is recognized for his in-depth knowledge of the electric power industry and his experiences as a witness in a variety of regulatory forums, including rate applications, power purchase agreement approvals, sale transactions and contract disputes.

Mr. Way was employed at TransAlta Corporation from 1974 to 2004 starting as a generation engineer, then holding several middle management and executive positions including Generation Scheduling, Power Planning, Network Operations, Energy Marketing, and Energy Risk Management. He held instrumental roles as the electric industry restructured since 1994 including the separation of functions, the adoption of power purchase agreements and the divestiture of regulated businesses. He was Vice-President, Regulatory Affairs from 1998 to 2004.

Since 2004, Mr. Way has provided consulting services to a number of clients. Mr. Way has a Master of Business Administration degree and a Bachelor of Science degree in Chemical Engineering, both from the University of Calgary.

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Day I – Thursday, August 22, 2019

- 9:30 am Registration
- 10:00 am **Opening**
Moderated by Ms. Sarah Blanford – USEA
- 10:00 am **Welcoming remarks**
Speaker: Mr. Michael Satin, Director of Clean Energy and Environment – USAID/India (TBC)
- 10:10 am **Inaugural session**
Speaker: Member, Central Electricity Authority (TBD)
- 10:30 am **Introductory remarks**
Speaker: Mr. Matthew Ogonowski, Activity Manager and Technical Specialist, Clean Energy – USAID/Washington
- 10:40 am **Summary of Indian experience and needs**
Speaker: GTG RISE
- This session will include a summary presentation of the current status of India’s challenge in the context of the grid’s dependence on coal vs. the financial and policy challenges facing the coal generators’ ability to operate flexibly; existing efforts to deal with this issue; key stakeholders (e.g. CEA coal flexing working group). The presenter will include an overview of what India has thus far recorded as the “real cost” of flexible operation of their coal fleet, and what qualifications does a plant need to have to operate flexibly.*
- 11:15 am Group photo and tea break

PART I – CASE STUDIES

The focus of Part I of this workshop will be to provide experiences from other countries on how best to support flexible operation of coal.

- 11:45 am **Assessing the real cost of coal flexing – integrated resource planning**
- For decades, coal generators have been operating as base-load plants. There is extensive experience and records to help a utility accurately account for its costs. However, flexible operation brings an entirely new set of variables –new operational, maintenance, parts replacement, and opportunity costs. Studies conducted worldwide on addressing increased renewable energy penetration through flexible operations of coal-based power plants have underscored the need to identify, measure and quantify the effects of low load operations and cycling of units. This session will focus on identifying these new variables and sharing how best to account for these new costs. This knowledge is critical to assessing the level of regulatory and policy incentives that need to be in place and determining the “price” of coal flexing to revise tariffs and new and existing PPAs for coal generation to make it more load following.*

- **Integrated Resource Planning – How to Plan for Flexibility**
Thad LeVar, Public Service Commission of Utah (25 minutes)
- **NETL experience in assessing the real cost of flexibility**
Jeffrey Hoffmann, National Energy Technology Laboratory (25 minutes)
- **Public Utility Regulatory Policies Act (PURPA) – How it Assesses RE Costs**
Thad LeVar, Public Service Commission of Utah (25 minutes)

1:15 pm

Lunch

2:00 pm

Assessing the real cost of coal flexing – integrated resource planning (continued)

- **RWE case study: Adapting a power plant portfolio to changing flexibility requirements**
Hans-Jürgen Behnke, RWE (25 minutes)
- **Ireland Integrated Single Electricity Market (ISM) case study: How to understand the inherent costs of coal flexibility**
Serhiy Zuyev, AES UK & Ireland (25 minutes)

3:00 pm

Adjusting a tariff to reflect actual cost of flexing

This session will discuss the redetermination of India’s tariff for coal generation.

India has been relying on a regulated flat tariff, wherein costs are largely determined by fuel costs. If a plant is producing more power (and using less fuel), it will be paid less. For generators required to reduce minimum load significantly (and often for long periods of time), thereby lowering their efficiency and incurring higher maintenance and replacement costs associated with flexible operation, this tariff structure will be financially unsustainable.

To address this inadequacy, regulators need to be accurately informed of the “real costs” of coal flexing, and regulated tariffs for coal generators will need to be adjusted. The good news is that even if coal generators are paid more, this path is proving to be more cost effective to the customers because flexibly-operated coal has lower fuel cost, even though maintenance costs go up.

In summary, utilities need to work very closely with their respective regulator so that both the utility and the regulator are anticipating as many of the costs as possible, and then these costs can be accurately passed through to the customer.

- **Overview of India’s case**
Moderator: CERC or CEA (15 minutes)
- **Utah regulatory case study: Stakeholder process – how to plan for a flexible generation integration and price it**
Dr. Laura Nelson, Utah Governor's Office of Energy Development (25 minutes)

- 3:45 pm Tea break
- 4:15 pm **Adjusting a tariff to reflect actual cost of flexing (continued)**
- **RWE case study: RWE’s ongoing process of adjusting their tariff to better reflect the real cost of flexible operation**
Hans-Jürgen Behnke, RWE (25 minutes)
- 4:45 pm **Policies & regulations to support flexibility**
- As earlier mentioned, while CERC has instituted a 55% minimum load requirement for coal generation, most utilities are not meeting this target. New central-level and state-level policies and regulations will need to be put into place to encourage flexible operation through appropriate compensatory methods.*
- **Utah case study: regulatory policies to support flexibility, recent policies to address changes in the market and how to engage the real-time market and the day-ahead market**
Dr. Laura Nelson, Utah Governor's Office of Energy Development (25 minutes)
- 5:15 pm **Open discussion, Q&A**
- 5:30 pm **Adjourn**
- 7:00 pm **USEA hosts dinner for speakers and participants**
Venue: Le Meridien, rooms 2010, 2020 & 2000

Day 2 – Friday, August 23, 2019

- 9:15 am Registration
- 9:30 am **Alberta’s shift from PPAs to a deregulated market** *(presenting via videoconference)*
Richard Way, Way Consulting Ltd.
- 9:50 Q&A
- 10:15 am **Policies & regulations to support flexibility (continued)**
- **Germany case study: How Germany’s market mode impacted the coal generation and their mechanisms to support generation flexibility**
Hans-Jürgen Behnke, RWE (45 minutes)
- 11:00 am Tea break

PART 2 – OPTIONS FOR INDIA

The focus of Part 2 of this workshop will be to go into more depth on some key options for India in the near term to support flexible operation of coal.

11:25 am

Modifying Power Purchase Agreements (PPAs) to foster flexibility

A large percentage of India's current coal generation is supplied through independent power producers (IPPs) with long-term power purchase agreements (PPAs). PPAs treat all power the same, whether it is available on a steady or intermittent basis (generally from coal or renewables, respectively). Such rigidity removes the market incentive to develop flexible power generation to complement renewable energy. Therefore, to maximize the IPPs' generation, the PPAs will need to be restructured.

- **Overview of India's case with long-term coal generation PPAs**
Shubhranshu Patnaik, GTG RISE (20 minutes)

11:45

Ancillary markets, capacity markets & other options for real time markets – what is the best choice for flexible coal generation in the future?

- **The Energy Imbalance Market (EIM) – How to price fossil ramping**
Thad LeVar, Public Service Commission of Utah (25 minutes)
- **Shifting from firm power to a capacity market – the UK experience**
Lawrence Slade, Energy UK (25 minutes)

1:00 pm

Lunch

1:00 pm

Ancillary markets, capacity markets & other options for real time markets – what is the best choice for flexible coal generation in the future? (continued)

- **Ireland case study: the shift away from a single energy market – introduction to a capacity market to an ancillary market and what drove the change in Ireland**
Serhiy Zuyev, AES UK & Ireland (25 minutes)
- **Germany case study: Flexibility auction and how it impacts generation**
Hans-Jürgen Behnke, RWE (25 minutes)

2:00 pm

Working Session

Moderated by Mr. Matthew Ogonowski – USAID, Ms. Sarah Blanford – USEA & US presenters

Delegates break into groups according to organization to develop action plan with next steps for regulatory, policy and other incentives to support flexible coal operation. Groups each develop an action plan containing specific steps with a timeline for achieving highlighted strategies and next steps.

3:00 pm

Tea break

3:30 pm

Groups present action plans

Moderated by Ms. Sarah Blanford – USEA

4:30 pm

Post-workshop evaluations

Moderated by Ms. Sarah Blanford – USEA

4:45 pm

Closing remarks

USAID

5:00 pm

Vote of thanks, followed by adjournment